Corals - Key To The Brain

Daniel E. Morse is an unusual scientist who has unlocked some of the deep mysteries of human physiology by studying creatures from the sea.

Morse, a professor of molecular genetics and biochemistry at the University of California, Santa Barbara, has focused some of his studies on the human brain, and he says the simpler genetic processes of marine animals are providing clues about the more complex physiological functions in humans.

For two years, a team of researchers working at the Smithsonian Tropical Research Institute in Panama took a microscopic look at corals under his direction.

Morse said that by focusing on corals — "one of the very simplest of multi-cellular animals," the scientists hoped to find a key to improving the diagnosis and treatment of disorders in the human brain.

The key, he said, is the way marine animals rely on chemical signals to control critical phases of their development.

"One of the very unique and beautiful features of life in the ocean is that the larvae of many marine animals drift in the plankton until they recognize some chemical signal that triggers them to settle and change into adult form," Morse said. This process involves what he has termed "signal molecules," and the functioning of these molecules enables each microscopic larvae to find a suitable environment to grow up in.

An example of this process is found in the red abalone, which does not settle out of the plankton currents until it receives a chemical signal emitted from red algae.

A signal emitted from the algae triggers the larval abalone to drop out of the plankton, where it not only finds suitable habitat (the rocks on which the algae is growing), but also the algae itself, which is necessary food to the animal.

The process — although relying on different signal molecules for each marine species — is one that closely resembles the nerve function in the human brain.

Noting the strong interaction between chemical signals from the algae to nerve cell receptors on the larvae, Morse said his researchers have learned that the same signal molecules from the marine algae can bind very selectively to receptors on the nerve endings in the mammalian brain.

He said corals may ultimately lead them to understanding the complex "wiring system" of the brain itself.

"It may be possible for us to dissect the mechanisms by which the signal molecules control development in these simpler animals. In turn, this would guide us in our search for mechanisms by which chemicals in the brain could control development of the nervous system," Morse said.

Morse's group is exploring the possibility of genetically engineering a variation of the marine molecules that will be useful for "improved diagnosis of brain disorders."

The molecules could be used in the newly developed, non-invasive procedure called positron-emission tomography, or PET-scan — which requires "specific molecular probes for different areas in the brain."

He added that the molecules may also be useful for "more effective treatment of brain disorders — with fewer side effects than presently possible."

Morse has received international recognition for his work identifying the molecular mechanisms controlling the reproduction and growth of shellfish.

Although his marine research has always been aimed at questions of human physiology, spinoffs of this research have resulted in mariculture techniques now used by commercial seafood-growing companies.

One of Morse's projects resulted in the discovery that abalone could be induced to spawn and settle by adding hydrogen peroxide to seawater.

The flip side of this research coin led his researchers to the discovery of a natural method which blocks the settling process — a discovery that has proved valuable to the U.S. Navy Office of Research. The Navy spends millions every year to rid marine organisms from the bottom of its vessels.

While his research has practical applications for mankind, Morse said the discoveries made by his scientific team also contribute to an understanding of the ecology and development of corals.

"These organisms represent one of the most ancient and highly diversified communities on earth, yet the corals themselves are developmentally and genetically among the very simplest animals in existence." — HILLARY HAUSER